Technical specification

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Devices to assist in reducing the risk to young pedestrians from reversing motor vehicles

1. Introduction

This specification sets out requirements for devices to assist drivers to reduce the risk of a child being run over by a reversing vehicle.

The specification is intended to be used as a guide for consumers, manufacturers and suppliers to assess commercially available products. It is not a legal requirement that devices fitted to vehicles comply with this specification.

2. Objectives

To provide guidelines to assess the two systems fitted to motor vehicles to reduce risks of reversing:

- A visual aid that gives the driver an improved view to the rear of the vehicle.
- A proximity sensor that detects the presence of an object (which may be a person) behind the vehicle.
- A combination of systems is likely to provide the most effective solution.

2.1 Visual aid

- The device should:
- Provide the driver with a reasonable view of crucial blind spots to the rear of the vehicle so a small child (such as a one year old toddler) standing in blind spots to the rear of the vehicle can be reliably detected.
- Avoid obstructing views that are needed for normal driving of the vehicle.
- Be effective in the full range of environmental conditions, including night-time (vehicle reversing lights may be used as a source of illumination at night).
- Only operate when reverse gear is engaged.
- Be simple to check for correct operation.
- Be durable with minimal maintenance.

2.2 Proximity sensor

The device should:

- Reliably detect a small child (such as a one year old toddler) standing in blind spots to the rear of the vehicle.
- Not discriminate between humans and other objects (the alarm may sound when any object is detected) but should not be set off by objects outside the field of interest.
- Only operate when reverse gear is engaged.
- Not (but may) alert the driver if both the vehicle and the object are stationary.
- Promptly alert the driver with an audible signal that an object has been detected.
- Preferably, give some indication of the range to the object.
- Optionally, give a visual signal to the driver that an object has been detected. This should be visible when the driver is looking to the rear.
- Be effective in the full range of environmental conditions.
- Give a minimum of false alarms.
- Be simple to check for correct operation.
- Be durable and require minimal maintenance.

It is preferred that the warning signal is not audible to a person located to the rear of the vehicle.

NOTE: Young children are unlikely to understand the purpose of such a warning signal and may even be attracted to it.

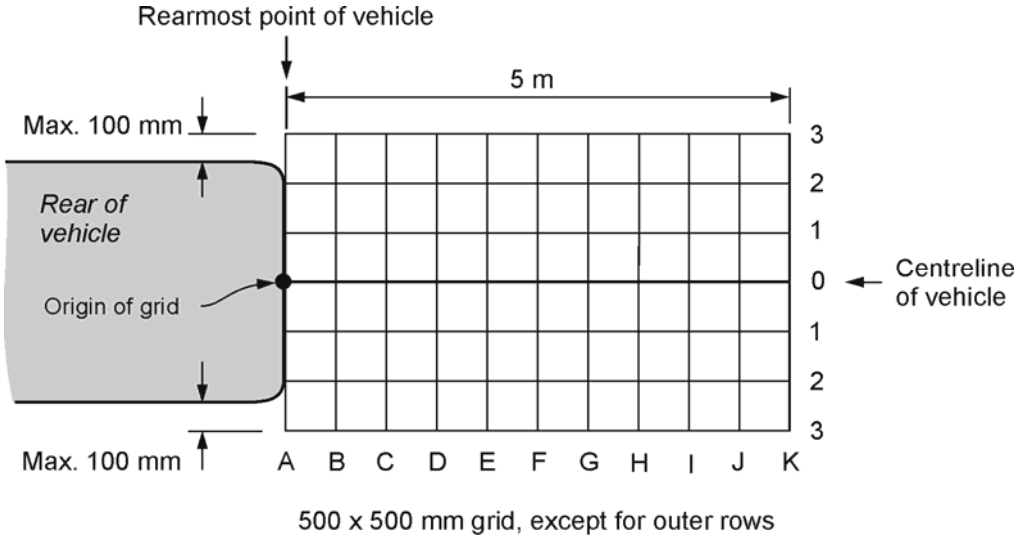
3. Determination of blind spots behind vehicles

To test the effectiveness of a system it is necessary to establish the blind spots for the particular vehicle to which it is to be fitted. This can be done by marking out a 500 mm x 500 mm grid on the ground to the rear of the vehicle, sequentially placing a test cylinder at each intersection of grid lines and determining whether the cylinder can be detected from the driver's seat (see following procedure). Any grid point where the top of the cylinder (not necessarily the whole cylinder) is not visible is deemed to be a 'blind spot'.

3.1 Location of grid

The grid origin is on the ground in line with the centreline of the vehicle and the rearmost point of the vehicle (excluding a towbar). A 500 mm x 500 mm grid is marked out from this point and extends to a longitudinal line that is 100 mm beyond the extreme width of the vehicle on each side and five metres rearward of the origin. The width of the outermost rows of the grid may be reduced for this purpose. See Figure 1.

FIGURE 1. Test grid behind vehicle



3.2 Test cylinder (for testing visual aids)

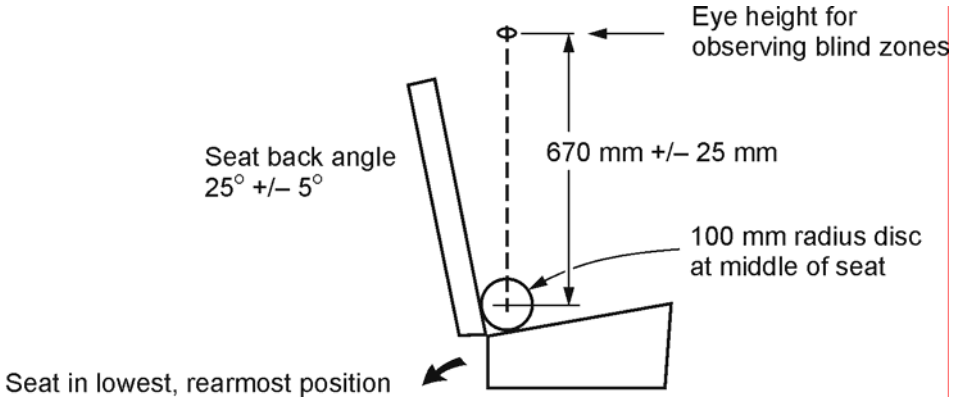
The test cylinder is 200 mm (+/– 20 mm) in diameter and 600 mm (+/– 50 mm) in height. This is based on the shoulder height of a standing two-year old or a kneeling adult. The cylinder may be constructed from any material.

The sides and top of the cylinder should be contrasting colours such as white and orange.

3.3 Preparation

The driver's seat should be adjusted to its lowest rearmost position. It is preferred that the driver's eye position be established using a 50th percentile adult male manikin in accordance with procedures set out by RCAR for head restraint assessment (www.rcar.org/papers.htm). However, the eye position for all tests may be determined using the simplified procedure illustrated in Figure 2.

FIGURE 2. Simplified method of establishing eye height



In addition to the height limits shown in the diagram the observer's eye should be within 100 mm transverse distance (left or right) of the longitudinal centreline of the seat and within 150 mm longitudinal distance (forward or rearward) from the 'eye height' point shown in Figure 2 (which is directly above the centre of the disk).

All driving mirrors should be adjusted for normal view of traffic, to suit the prescribed observing position.

The vehicle should not be adjusted or loaded in such a way that its body angle (attitude) is unusual. All head restraints should be fitted and adjusted for adult occupants. All seats other than the driver's should be unoccupied but adjusted for adult use (not reclined or stowed). Spare wheels and other removable components should be in their normal position for travel.

The ground should be flat and sealed over the area where the vehicle is standing and continue without change over the area covered by the grid. The test site should be well lit – artificial light may be used.

3.4 Method of determining blind spots

This method uses a test cylinder and marked grid on the ground. Alternative, equivalent methods may be used if they are properly documented.

Starting with the transverse gridline B (500 mm to the rear of the origin) test each grid point along this line as follows.

- Place the test cylinder with the centre of one end located over the intersection of the gridlines (+/ 20 mm).
- Sit in the driver's seat and try to observe the cylinder by looking backwards through the rear window or forwards using the internal rear view mirror and the external rear view mirrors.

- If any part of the cylinder can be observed note the method(s) of observation (D=direct, I=internal mirror, L=left hand external mirror, R=right hand external mirror) for that gridpoint. Otherwise record an X, indicating a blind spot.
- Test the remaining gridpoints along that transverse gridline, unless it is evident that they will also be blindspots.
- Move to the next rearward transverse gridline (eg C) and repeat the process until all grid points up to five metres rearward of the origin have been assessed.

4. Requirements for devices to aid driver visibility

4.1 General

This section is intended to apply only to electronic video equipment. It is unlikely that conventional auxiliary mirrors or wide-angle lenses would meet the performance requirements of the specification, particularly the limits on image size and the requirement for night-time operation. However, the specification is not intended to preclude innovative systems and the terms 'camera' and 'screen' could include other devices.

4.1.1 Applicable vehicles

Because of the wide range of designs of vehicles it may be necessary to test the visual aid on each type of vehicle for which it is intended to be used. These vehicles should be promoted in marketing brochures for the system and instructions for specific vehicles nominated, if appropriate. Where universal fitting is proposed the manufacturer should be prepared to demonstrate why the performance can be expected to be no worse on other vehicles than for the vehicle(s) on which the system was tested. Recommended camera locations may need to be provided for a range of vehicles.

4.1.2 Design and durability

The components of the device must be designed to withstand the harsh conditions encountered in vehicle operation. They must be durable and corrosion-resistant.

Unless located entirely within the vehicle cabin, all components should be resistant to weather, vandalism and theft.

The device must not constitute a hazard to occupants within the vehicle due to exposed hard or sharp edges and must be constructed from shatterproof materials. Where the screen is located on a portion of the vehicle that is required to be energy absorbing, such as the padded portion of the dashboard, then it will be necessary to demonstrate continued compliance with Australian Design Rule 21 (for more information refer to *Vehicle Standards Information No 6 'Guidelines for light vehicle modifications').*

The device must not interfere with the deployment of any airbag.

The rear view picture should appear on the display whenever the ignition is on and reverse gear is selected.

It is preferred that the screen is capable of displaying a mirror image.

4.1.3 Location of screen/lens

Where the display is not integrated with another device (such as a navigation system), it is preferred that the screen (or lens) is located and aligned so that it is close to the direct field of view to the rear or the view of the internal rear view mirror. That is, the driver should not have to turn their head to see both the device and the direct view to the rear (or the view in a rear view mirror).

If the display is integrated into the internal rear view mirror then the image must be clearly visible when the mirror is adjusted to view a bright scene through the rear window. Bright reflections must not obscure the image.

4.1.4 Effect on driver's vision of traffic

With the device located and adjusted to provide vision of blind spots (see next section) the driver's normal view of traffic to the front, rear and side should not be adversely affected by the camera, screen or other component of the system.

4.2 Performance tests

Using the vehicle/grid configuration shown in Figure 1, assess each of the locations **found to be a blind spot without the device.**

- Place the test cylinder with the centre of one end located over the intersection of the gridlines (+/– 20 mm).
- Sit in the driver's seat with the eye position described in 3.3 and try to observe the cylinder using the device.
- If all of the top surface of the cylinder can be observed then record that the blind spot has been successfully eliminated.
- Test the remaining 'blind spot' gridpoints.

4.2.1 Image size

When the 600 mm tall test cylinder is located five metres from the rear of the vehicle (in line with the centreline of the vehicle) then the height of its image on the screen should be no less than 0.5 per cent of the distance between the driver's eye and the screen. For example, if the driver's eye is 800 mm from the screen then the height of the cylinder image on the screen should not be less than 4 mm.

4.2.1 Night-time performance

When the 600 mm tall test cylinder is located five metres from the rear of the vehicle (in line with the centreline of the vehicle) it should be discernible on the screen where the only significant source of illumination at night is light from the reversing lamps of the test vehicle or alternative source of illumination that operates automatically in conjunction with the device, such as an infrared lamp.

4.2.2 Assessment

To comply with this specification the device must provide a view of the cylinder for all grid locations that were found to be blind spots without the device and it must meet the requirements for image size and night-time performance. If grid points that are close to the vehicle are not observable then it may be beneficial to use a sensor system in combination with the visual aid (see next section).

5. Requirements for proximity sensors

5.1 General

This section covers proximity sensor systems mounted on the rear of the vehicle. The detection test is conducted with an adult dressed in loose conventional clothes and, in particular, long trousers. The ignition should also be 'on' so that the proximity sensor is operational but, the engine should not be running. An alternative power source may be provided instead of using vehicle power.

5.1.1 Applicable vehicles

Because of the wide range of designs of vehicles it may be necessary to test the device on each type of vehicle for which it is intended to be used and to nominate such vehicles in marketing brochures for the system, including instructions for specific vehicles, if appropriate. However, it is acceptable for worst-case vehicles to be assessed and for the device to be marketed for other vehicles of the same type (principally the mounting height of the sensor). The worst case vehicle will normally be the one for which a blind spot exists further from the rear of the vehicle than other types of vehicle in its class.

5.1.2 Design and durability

The device must be designed to withstand the harsh conditions encountered in vehicle operation. It must be durable, weatherproof and corrosion-resistant.

It should be resistant to vandalism and theft.

The device should take no more than 0.5 seconds to trigger the audible alarm, once an object moves into the detection zone.

5.1.3 Audible warning

The sound level of the alarm should be loud and clear so that it can be heard above the normal noise level within the vehicle.

If there is doubt about whether the signal is loud and clear a sound level test should be conducted. A sound level of at least 90dBA at one metre distance is recommended. The sound level must not be less than 80dBA. Manufacturer's specifications for the audible alarm may be used as evidence of compliance with this recommendation.

5.2 Performance tests

5.2.1 False/nuisance alarm test

The system must be designed to minimise the occurrence of false/nuisance alarms. In particular small bumps and irregularities on the ground should not cause the alarm to trigger. This can be tested by placing a rectangular piece of metal or similar object (other than wood), across the path and reversing the vehicle towards and over the object. The height of the object should be 30 mm (+/– 5 mm) and its width, across the path, should be at least one metre. If the alarm sounds then the system should be adjusted so that it no longer triggers. Systems that cannot be adjusted to prevent such false/nuisance alarms will not meet this specification. The detection zone test may then proceed.

False/nuisance alarms to the side (objects beyond 100 mm from the extreme width of the vehicle, excluding mirrors) are undesirable but are not a reason for non-compliance with this specification.

5.2.2 Detection zone test

Using the vehicle/grid configuration shown in Figure 1, assess each of the longitudinal gridlines as follows:

- Chock the car.
- With the ignition on but the engine not running, select reverse gear.
- Have the testing officer stand on the applicable longitudinal gridline at a distance that is beyond the detection range, or five metres.
- Record the response from the alarm system (type of audible alarm, type of visual warning).
- Have the person slowly walk towards the vehicle along the longitudinal gridline until the alarm sounds. Note this distance. Have the person continue to move towards the vehicle and note any change in the type of alarm. Have them approach the vehicle until they touch the rear of the vehicle.
- Test the remaining longitudinal gridlines.
- With the person at a location where the alarm sounds, disengage reverse gear and check that the alarm deactivates.

5.2.3 Extra tests for high-mounted or microwave radar sensor systems

If any of the proximity sensors are mounted higher than 700 mm from the ground, repeat the tests with the person crawling or crouching so that they are no higher than 700 mm.

If the sensor system utilises microwave radar then check for reduced detection range with the vehicle reversing slowly and the person standing still. This can be done by having the person walk towards the stationary vehicle until they are detected (as described above). Then the person stands still at this point and the vehicle begins to reverse slowly. The person should still be detected under these circumstances. If not then more specialised and carefully supervised tests will need to be conducted to establish the detection zone while the vehicle is reversing and the person is stationary.

6. Assessment and labelling

6.1 Assessment of combined systems

It is unlikely that a proximity sensor device will be able to cover all blind spots to the rear of a vehicle and not be subject to false alarms. Therefore it will usually be necessary to assess a sensor system in combination with a visual aid. The intention is that the proximity sensor will cover blind spots that are close to the vehicle and are not within the field of view of the visual aid.

A plan view of the rear of the vehicle should be produced. This should show, for the test cylinder situation (ie the 600 mm contour line):

- The boundaries of the blind spots, out to 5 m from the rear of the vehicle.
- The limits of any visual aid.
- The limits of any proximity sensor.

To comply with this specification the system must cover all blind spots within 5 m of the rear of the vehicle by either visual aid, proximity sensor or both.

Note that since the first gridline is located 500 mm from the rear of the vehicle it is possible that a child could position themselves against the rear of the vehicle but out of angular range of the sensor or camera. It is preferred that the system is able to cover this situation, at least for most positions along the bumper, but it is not essential for compliance with this specification.

6.2 Labelling

All systems must include a label that is affixed to the vehicle. The label should contain words such as:

'This vehicle is fitted with a system to assist the driver when reversing. Even with this device the driver must take great care when reversing. Children must be supervised by adults whenever they are near moving vehicles.'

The preferred location for the label is on the centre pillar of the driver's doorway or on the end of the instrument panel so that it is visible when the driver's door is opened.

Packaging and promotional material may indicate that the system has been designed to comply with this specification. Words similar to the above should be included on the packaging. The packaging should also indicate the voltage for which the equipment is designed.

For further enquiries:

ww.rta.nsw.gov.au tech-enq@rta.nsw.gov.au

1300 137 302

02 9843 3821

RTA Technical Enquiries, PO Box 1120, Parramatta NSW 2124